

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 16

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DIETRICH STEPHANI
and
HEINZ MITLEHNER

Appeal No. 1999-0887
Application No. 08/702,074

ON BRIEF

Before THOMAS, HAIRSTON, and RUGGIERO, Administrative Patent Judges.

RUGGIERO, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on the appeal from the final rejection of claims 1, 4, 5, and 9-36. Claims 2, 3, and 6-8 have been indicated by the Examiner to be allowable subject to being rewritten in independent form to include all of the limitations of the base and intervening claims.

The claimed invention relates to a barrier junction

termination structure for a silicon-based semiconductor component. The semiconductor component has a semiconductor region which forms a depletion region in the active area of the semiconductor component. The junction termination, which surrounds the active area on or in a surface of the semiconductor region, is formed with silicon with a doping opposite to that of the semiconductor region, the dopant having an impurity level of at least 0.1 eV in silicon.

Claim 1 is illustrative of the invention and reads as follows:

1. A semiconductor component comprising:

at least one silicon semiconductor region with n-type conduction, the semiconductor region forming a depletion region in an active area of the semiconductor region when an off-state voltage is applied to the active area; and

a junction termination for the active area, the junction termination being disposed around the active area at or in a surface of the semiconductor region, the junction termination comprising silicon with p-type conduction, the silicon with p-type conduction of the junction termination being doped with at least one dopant having an acceptor level of at least approximately 0.1 eV in silicon.

The Examiner relies on the following prior art:

Jenny

2,809,165

Oct. 08,
1957

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Bemski	2,827,436	Mar. 18, 1958
Temple	4,242,690	Dec. 30, 1980
Jaecklin	4,742,382	May 03, 1988
Okabe et al. (Okabe)	5,510,634	Apr. 23, 1996

1994) (filed Oct. 18,

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J. S. Moore et al. (Moore), "Energy Levels in Cobalt Compensated Silicon," 41 Journal of Applied Physics, No. 13, 5282-85 (December 1970).

Claims 1, 4, 5, and 9-36 stand finally rejected under 35 U.S.C. § 103(a). As evidence of obviousness, the Examiner offers Temple in view of Moore with respect to claims 1, 5, 9, 10, 14, 16-21, 25, 26, 30, and 32-36, adds Jaecklin to the basic combination with respect to claims 11-13, and 27-29, and adds Okabe to the basic combination with respect to claims 15 and 31. In separate rejections under 35 U.S.C. § 103(a), claims 21-23 are rejected as being unpatentable over Temple in view of Jenny, and claims 1, 4, and 5 are rejected as being unpatentable over Temple in view of Bemski.

Rather than reiterate the arguments of Appellants and the Examiner, reference is made to the Briefs¹ and Answer for the respective details.

OPINION

It is our view, after consideration of the record before

¹ The Appeal Brief was filed May 26, 1998 (Paper No. 10). In response to the Examiner's Answer dated August 4, 1998 (Paper No. 12), a Reply Brief was filed October 13, 1998 (Paper No. 13), which was acknowledged and entered by the Examiner as indicated in the communication dated October 23, 1998 (Paper No. 14).

us, that the collective evidence relied upon and the level of skill in the particular art would not have suggested to one of ordinary skill in the art the obviousness of the invention as set forth in claims 1, 4, 5, and 9-36. Accordingly, we reverse.

With respect to independent claims 1 and 21, the Examiner, as the initial basis for an obviousness rejection, proposes to modify the semiconductor device of Temple which describes a high breakdown voltage device having a junction extension region adjacent to a p-n junction termination. According to the Examiner, Temple discloses the claimed invention except that the reference " . . . does not teach the dopant in the junction region to have an acceptor or donor level greater than 0.1 eV in silicon." (Final Office action, page 3). To address this deficiency, the Examiner turns to Moore which discloses the doping of silicon with cobalt which exhibits an energy level greater than 0.1 eV in silicon. In the Examiner's analysis, "[i]t would have been obvious to a person of ordinary skill in the art at the time of invention to use cobalt as either a donor or acceptor dopant as taught by Moore et al. in the device of Temple to increase said

device's breakdown voltage." (Id.)

In response, Appellants assert that the Examiner has failed to set forth a prima facie case of obviousness since proper motivation for one of ordinary skill to make the Examiner's proposed combination has not been established. Upon careful review of the applied prior art, we are in agreement with Appellants' stated position in the Briefs. The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 1266 n.14, 23 USPQ2d 1780, 1783-84 n.14 (Fed. Cir. 1992).

It is our view that, while a showing of proper motivation does not require that a combination of prior art teachings be made for the same reason as Appellants to achieve the claimed invention, we can find no motivation for the skilled artisan to apply the cobalt doped silicon teachings of Moore to the semiconductor device of Temple. As pointed out by Appellants (Brief, page 8), Moore is directed to the measurement of

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certain characteristics such as resistivity and Hall effect on laboratory samples of cobalt doped silicon. We fail to see how the laboratory sample measurement disclosure of Moore would have any relevance to the semiconductor device structure of Temple,

let alone the specific claimed doping of the device junction termination region. There is nothing in the disclosure of Temple to indicate that the regulation of the electrical characteristics measured in Moore was ever a concern. It is our opinion that

the only basis for applying the teachings of Moore to the semiconductor device structure of Temple comes from an improper attempt to reconstruct Appellants' invention in hindsight. Accordingly, since the Examiner has not established a prima facie case of obviousness, the rejection of independent claims 1 and 21, and claims 4, 5, 9-20, and 22-36 dependent thereon, over the combination of Temple and Moore is not sustained.

Turning to a consideration of the Examiner's separate 35 U.S.C. § 103(a) rejection of independent claim 1, and dependent claims 4 and 5, based on the combination of Temple

and Bemski, we do not sustain this rejection as well. As the basis for this rejection, the Examiner proposes to add Bemski's disclosure of cobalt or nickel doped silicon, and its described advantages in increasing minority carrier lifetime, to the teachings of Temple. In the Examiner's view, "[i]t would have been obvious to a person of ordinary skill in the art at the time of invention to use cobalt or nickel as an acceptor dopant as taught by Bemski in the device of Temple to improve the minority carrier lifetime." (Final Office action, page 5).

In response, Appellants' arguments mirror those made supra with respect to the Moore reference, arguments with which we agree for essentially the same reasons as discussed previously. The disclosure of Bemski is directed to the heat treatment of a single crystal silicon body in the presence of nickel or cobalt to improve minority carrier lifetime. We find nothing in the disclosure of Bemski, however, which would indicate any practical application of the disclosure to semiconductor component devices or components, let alone to the specific claimed junction termination region of such devices. As particularly set forth at column 7, lines 32-34

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of Bemski, " . . . the practical application of this invention is restricted to single crystal silicon." In view of the above, we are left to speculate why the skilled artisan would employ the single crystal silicon body teachings of Bemski in the semiconductor device of Temple. The only reason we can discern is improper hindsight reconstruction of Appellants' claimed invention. In order for us to sustain the Examiner's rejection under 35 U.S.C. § 103, we would need to resort to speculation or unfounded assumptions or rationales to supply deficiencies in the factual basis of the rejection before us. In re Warner, 379 F.2d 1011, 1017, 154 USPQ 173, 178 (CCPA 1967), cert. denied, 389 U.S. 1057 (1968), reh'g denied, 390 U.S. 1000 (1968).

Lastly, with the above discussion in mind, we also do not sustain the Examiner's separate obviousness rejection of claims 21-23 based on the combination of Temple and Jenny. Although Jenny provides a disclosure of the doping of silicon with sulfur or selenium, dopants which have a donor energy level greater than 0.1 eV in silicon, there is nothing which would indicate the suitability of such a material for a junction termination. We agree with Appellants (Brief, page 15) that, at best, Jenny provides a teaching of utilizing sulfur and selenium doped silicon in the active region of a semiconductor device. Such a teaching, however, falls well short of providing motivation to the skilled artisan to utilize such material in the junction termination region of a semiconductor device, particularly in the manner specifically set forth in the appealed claims.

We have also reviewed the Jaecklin and Okabe references applied by the Examiner to address the stacked layers and field ring structure, respectively, of several dependent claims. We find nothing in either of these references, however, that would overcome the innate deficiencies of the Temple, Moore, Bemski, and Jenny references discussed

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previously.

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In conclusion, we have not sustained the Examiner's
35 U.S.C. § 103 rejections of any of the claims on appeal.
Accordingly, the decision of the Examiner rejecting claims
1, 4, 5, and 9-36 is reversed.

REVERSED

JAMES D. THOMAS)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
KENNETH W. HAIRSTON)	APPEALS AND
Administrative Patent Judge)	INTERFERENCES
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